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Providing Support for ‘Support’: Parents’ Use of Verbs and Prepositions When Describing Support Configurations to Their Children

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ABSTRACT

Support (one object preventing another from falling) is linguistically encoded by adults and children in a highly structured and differentiated way, with basic locative expressions or Light verbs (e.g., in English, the block *is on/put on* the box) encoding Support-from-Below, and lexical verbs (e.g., she *stuck* the block *on* the box) encoding Mechanical Support. We ask whether parents use such highly differentiated language when describing support configurations to their young children and whether the age of the child moderates this effect. We found that when parents of children 6-months to 3.5 years of age described events of Support-from-Below and Mechanical Support to their children, they did use distinct linguistic expressions, encoding Support-from-Below with Light verbs (e.g., *put on*) and Mechanical Support with other lexical verbs (e.g., *stick on/to*). This differentiation was especially prominent for parents of the oldest children, who used more lexical verbs (*stick*), and fewer Light verbs (*put*), to encode Mechanical Support. These findings are the first to demonstrate that parents’ spatial language to their young children distinguishes between two distinct types of support and suggest that parent input may play an important role in helping children learn to linguistically carve up the semantic domain of support. This sets the stage for future research to test the causal connection between the two.

The semantic space of “support” (one object preventing another object from falling) is quite complex, raising the question of how children acquire language in this domain. This complexity is highlighted in recent semantic analyses that consider how the same spatial term, i.e., *on* in English (or other prepositions or postpositions across languages), applies to a wide variety of support mechanisms that embody different kinds of “force dynamic” relations between two objects, all resulting in support of one by another (Talmy, 1988; Vandeloise, 1991). For example, blocks on boxes embody a support mechanism in which one object is contiguous with and beneath another object (henceforth, Support-from-Below or SFB), thereby preventing it from falling. By contrast, for stamps *on* envelopes, the mechanism of support is adhesion and for configurations of coats *on* hooks, hanging leads to support. Thus, unlike “geometric” terms, such as *above/below/left/right*, that arguably depend only on the geometric relationships between objects defined by their

axes (Landau, 2017), terms such as *on* (and *in*) depend on the functional relationship between two objects, which can vary considerably.

Landau and colleagues (Johannes, Wilson, & Landau, 2016; Landau, Johannes, Skordos, & Papafragou, 2017) report that within the language of support, there is a “division of labor”, in which configurations of SFB (e.g. block on box) are linguistically differentiated from other configurations of support that rely on specific mechanisms (e.g. coat on hook involves hooking, stamp on envelope involves sticking). This differentiation shows up remarkably early in children’s language; for example, in the spontaneous speech of children 1.5 to 4.5 years (Lakusta, Brucato, & Landau, 2020). Utterances including *on* were extracted from Childes database (MacWhinney, 2000) and coded for the type of support they referred to. Children overwhelmingly used Light verbs + *on* (e.g., *put on*) to encode dynamic SFB configurations (e.g., cup being put on a plate) – a verb construction that is likely the basic locative construction for encoding dynamic events of SFB (as explained below). In contrast, children used other constructions – including ones with lexical verbs specifying manner of attachment (henceforth, MoA verbs) – to encode Mechanical Support (e.g., “Velcro *sticking* to the wall”). Although the use of MoA verbs was infrequent in children’s descriptions (N = 37 out of 1188 utterances), when these verbs were used with *on*, they were used only for encoding Mechanical Support configurations and not SFB.

The early presence of such a division of labor in young children’s language raises the question of what may explain its development. One possibility is that the spatial configuration of SFB plays a “special” role in children’s early understanding of physical support; indeed, research by Baillargeon and colleagues has shown that infants reason about SFB by 5 months of age (see Baillargeon & DeJong, 2017). Specifically, an object on top of a base (i.e., an object *supported from below*) will remain stable, but an object that is put on the side of a base (for example, *via a mechanism such as adhesion*) will fall (e.g., Needham & Baillargeon, 1997)

However, even if children’s early spatial representations “privilege” SFB in the space-language mapping, children still must learn the *linguistic expressions* that differentiate between SFB and Mechanical Support. How does this learning take place? We hypothesize that parent input may play a role, as has been found for other areas of spatial language acquisition (e.g., Casasola, Bhagwat, Doan, & Love, 2017; Pruden, Levine, & Huttenlocher, 2011). Specifically, parents may provide specific, differentiated semantic-syntactic structures to differentiate SFB from other kinds of Mechanical Support relationships. This information could then result in different language expressions mapping to distinct conceptual ones.

Here, we provide the first step in testing this hypothesis. We do so by 1) focusing on two configurations of support that have been used extensively in infant cognition research exploring infants’ physical knowledge of support: SFB (block on top of a box) and Mechanical Support via adhesion (block stuck to the side of a box) (see Baillargeon & DeJong, 2017 and discussion above), and 2) by testing parents of children over a very broad age range – 6 months to 3.5 years. To our knowledge, this is the very first test of how parents describe two fundamentally different types of support configurations to their young children.

We tested parents with children over this broad range because children are learning these terms between these ages and their semantic space is becoming more differentiated. As early as 12 months, ~25% of children learning English are reported to comprehend *on* (e.g., Frank,

Braginsky, Yurovsky, & Marchman, 2016). By 20-months, infants preferentially map BE *on* to configurations of SFB (block on top of box) over Mechanical Support (block stuck to side of box; Lakusta et al., 2020). By 2–3 years, children produce *on* (and its cross-linguistic equivalents) to encode a variety of support configurations (e.g., Genter & Bowerman, 2009). Further, parents may provide distinct linguistic structures to encode SFB and Mechanical Support prior to 12 months. Thus, we test parents of 6-month-olds as well, thus providing a thorough test of parents' support language from 6 months to 3.5 years.

We hypothesize that when parents are asked to describe SFB and Mechanical Support to their children, they will use verb classes with distinct semantic-syntactic structures to do so, consistent with the differentiation of the semantic space that has been reported in previous studies (e.g., Landau et al., 2017). Specifically, parents will use Light verbs + *on* for a dynamic event portraying SFB (e.g. a toy being put on top of a box) and MoA verbs (e.g., stick) for an event portraying Mechanical Support (e.g. a toy being stuck to the side of a box). Like the basic expression BE *on*, Light verbs (e.g., put, place) are semantically bleached, i.e. they do not encode any specific manner of attachment, but do encode physical support when co-occurring with *on* (e.g., “the toy is on the box”; “the girl put the toy on the box”). In contrast, verbs such as *stick*, do encode a specific manner of attachment (adhesion) and may co-occur with a variety of spatial prepositions when encoding support (e.g., “the girl sticks the toy to/on the box”).

Further, we hypothesize that if the age of the child modulates parents' use of MoA verbs, then an increase in MoA verbs by parents should occur when children are around 2 years of age – the age which children begin to use MoA verbs (“stuck to your body”; Lakusta et al., 2020). Parents of younger children may use Light verbs (*put*) – a semantically bleached verb – to encode Mechanical Support.

Method

Participants

Participants (N = 190) were parents (n = 185 mothers, 5 fathers) of children who had participated in a non-related categorization and/or language comprehension study earlier in the lab.¹ Five child age groups were represented: 6-months (N = 41; 18 females; *M* age = 6 months 7 days; range: 5 months 18 days–6 months 19 days), 12-months (N = 34; 12 females; *M* age = 11 months 30 days; range: 11 months 17 days–12 months 22 days), 20-months (N = 41; 17 females; *M* age = 19 months 24 days; range: 19 months 16 days–20 months 17 days), 2;0–2;6 years (N = 36; 13 females; *M* age = 2;2) and 2;7--3;6 years (N = 38; 21 females; *M* age = 3;3)

Stimuli, design, and procedure

The stimuli were two dynamic events (10 sec. each) portraying one object being supported by another object. In one event, a person's hand placed a small block *on top of* a large box

¹Since the children participated in different studies, it is not possible to examine the child data in relation to the current data. Rather, the current study's goal is to test the nature of parent input, which will set the stage for future studies. Given the current results, future studies should specifically relate parent input to child outcomes (see Discussion).

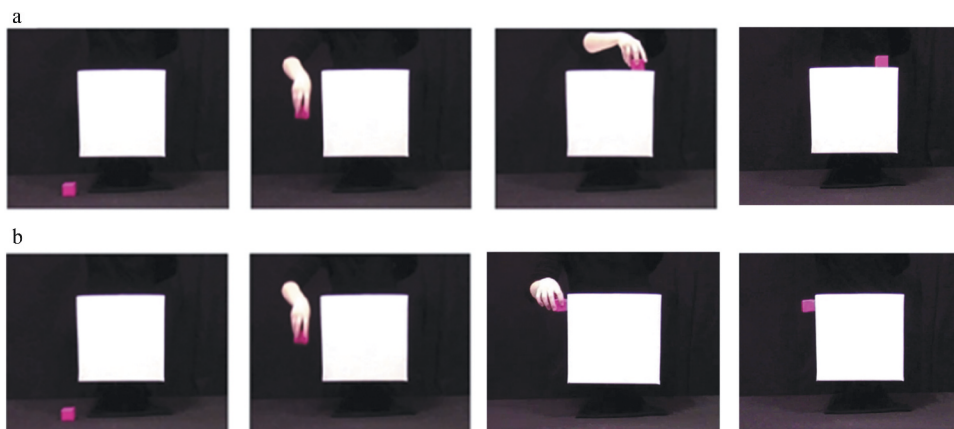


Figure 1. Pictures of the *dynamic* events parents described to their children. Panel A depicts the BLOCK BEING PUT ON TOP OF A BOX (“Support-from-Below”) and panel B depicts the BLOCK BEING PUT ON THE SIDE OF A BOX (“Mechanical Support”). Figure note: In each event, the hand entered the screen, picked up the block, and moved (3 seconds) and placed the block on top of (Panel A – SFB) or on the side of (Panel B – Mechanical Support) the box. The hand then retracted to leave the block in place on the box. In both events, the block had a translucent piece of tape which enabled it to adhere to the side of the box.

and in another event the hand placed a block (with hidden double-sided tape) *on the side of* a large box (Figure 1). The hand then retracted to leave the block in place on the box.

After the child study concluded,² the child remained seated on the parent’s lap. Parents were given the following instructions: “We are going to show you the video that <CHILD NAME> just saw. We would like you to watch it, and then after describe to <CHILD NAME> what happened.” Parents then viewed the dynamic support events (block placed on top OR on the side of a large box); at the end of each event a gray screen with the words “What happened?” appeared and signaled to the parent that they should describe the event to their child. The events were shown sequentially, and the order of presentation was counterbalanced across participants. All sessions were video-recorded and later transcribed for analysis.

Results

The parents’ descriptions were transcribed and coded in terms of the type of verb and the preposition. A second person coded all the utterances; reliability was above 90% and any disagreements were resolved by a third coder (the first author).

Verb coding

We classified verbs as 1) Light verbs – motion verbs that are semantically bleached (e.g., *put*, *go*) and have been found to encode SFB in *dynamic* events (Lakusta et al., 2020) or as 2) manner of attachment verbs (MoA; e.g., *stick*, *attach*) – a verb class that has been found to

²While the children participated in the prior, non-related study, they were seated on the parent’s lap. Parents closed their eyes and wore headphones playing music to avoid being influenced by the visual stimuli and to mask any audio.

encode Mechanical Support when used by adults as well as young children (Lakusta et al., 2020; Landau et al., 2017). Out of the full set of utterances ($N = 380$), 66% included Light verbs and 28% included MoA verbs; the remaining 6% included “Other” verbs, that did not fall into one of these two classes and were excluded from the analyses.

Parents showed clear distinctions in how they used Light and MoA verbs to encode the SFB vs. Mechanical Support events to their children. For the SFB event, 88.4% percent ($N = 168/190$) of the parents used Light verbs (*go*, *move*, *put*; for example, “a hand *put* a block on top of the box”), with most frequent uses being *put* (82.7% of all the Light verbs used). In contrast, only 3.7% ($N = 7/190$) of the parents used MoA verbs to encode SFB (e.g., “Did the square get *stuck* to the box?”). For the Mechanical Support event, the pattern was opposite of the one for SFB: 52.1% ($N = 99/190$) of the parents used MoA verbs to encode Mechanical Support (e.g., “the hand *stuck* the pink block to the white box”),³ whereas 42.6% ($N = 81/190$) of the parents used Light verbs (e.g., “she *put* the block on the side of the box”). Again, *put* was used most frequently (80.2% of all the Light verbs used). Thus, the majority of parents used Light verbs for SFB and MoA for Mechanical Support.⁴

In order to statistically test this pattern of verb use for SFB vs. Mechanical Support and to explore whether the age of the child modulated any effects, we first focused on Light verbs. The raw data were coded in terms of 1/0 for the parent’s use of a Light verb (or not) across the two support events (SFB, Mechanical Support). We entered these data into a mixed model logistic regression analysis. Support Type (SFB vs. Mechanical Support) and child’s Age Group were treated as fixed-effect factors and Subject was treated as a random effect. As shown in Figure 2, both fixed effects were significant in predicting Light verb use; parents used Light verbs more to describe SFB (*BOX ON TOP*) than Mechanical Support (*BOX ON SIDE*) ($B = 2.45$, $p < .001$, 95% CI[1.36, 3.04]) and parents of the oldest children (2;7–3;6 years) used significantly *fewer* Light verbs than parents of children 6 months ($B = 1.37$, $SE = 0.41$, $p = .001$, 95% CI = 0.57–2.17), 12 months ($B = 1.14$, $SE = 0.42$, $p = .007$, 95% CI = 0.31–1.97), and 20 months ($B = 1.21$, $SE = 0.40$, $p = .003$, 95% CI = 0.42–2.01) old. Focusing on MoA verbs, a similar regression analysis was performed as above except that the data were coded in terms of a 1/0 for the parent’s use of a MoA verb (or not) across the two support events (SFB, Mechanical Support). The results again revealed that both Support Type and Age Group were significant in predicting MoA verb use; parents used MoA verbs to describe Mechanical Support (*BOX ON SIDE*) more than for SFB (*BOX ON TOP*) ($B = -3.62$, $p < .001$; 95% CI[−4.60, −2.64]) and parents of the oldest children (2;7–3;6 years) used MoA verbs significantly more than parents of children 6 months ($B = -1.86$, $SE = 0.48$, $p < .001$, 95% CI = −2.80–0.92), 12 months ($B = -1.33$, $SE = 0.48$, $p = .006$, 95% CI = −2.29–0.38), and 20 months ($B = -1.81$, $SE = 0.48$, $p < .001$, 95% CI = −2.74–0.87) old (see Figure 2). Additional separate logistic regression models were performed for parents’ use of Light and MoA verbs with 1) child’s sex and 2) order of stimulus

³When parents didn’t use a Light or MoA verb for SFB they used BE (3.2%; $N = 6/190$), lift (1%; $N = 2/190$), watch (.5%; $N = 1/190$) or they omitted a verb (3.2%; $N = 6/190$). When parents didn’t use a Light or MoA verb for Mechanical Support they used BE (3.2%; $N = 6/190$), lift (.5%; $N = 1/190$), or push (1.6%; $N = 3/190$).

⁴It may also be of interest to note that for the Mechanical Support events when *put* was used, an agent was included in the large majority of the utterances (e.g., “She put the block on the side of the box”; only three utterances did not include an agent). When *stuck* was used – the most frequently used verb to encode the Mechanical Support – an agent was specified 73.84% of the time (e.g., “Someone stuck it to a big white square”); 27.16% of the time an agent was not specified (e.g., “The square stuck to the side of the box”). Thus, for Mechanical Support, parents use more MoA verbs, and they use these in mixed constructions. Future research may examine how the varied verb constructions for MoA verbs may play a role in children acquiring their meanings. Thank you to an anonymous reviewer for suggesting this point.

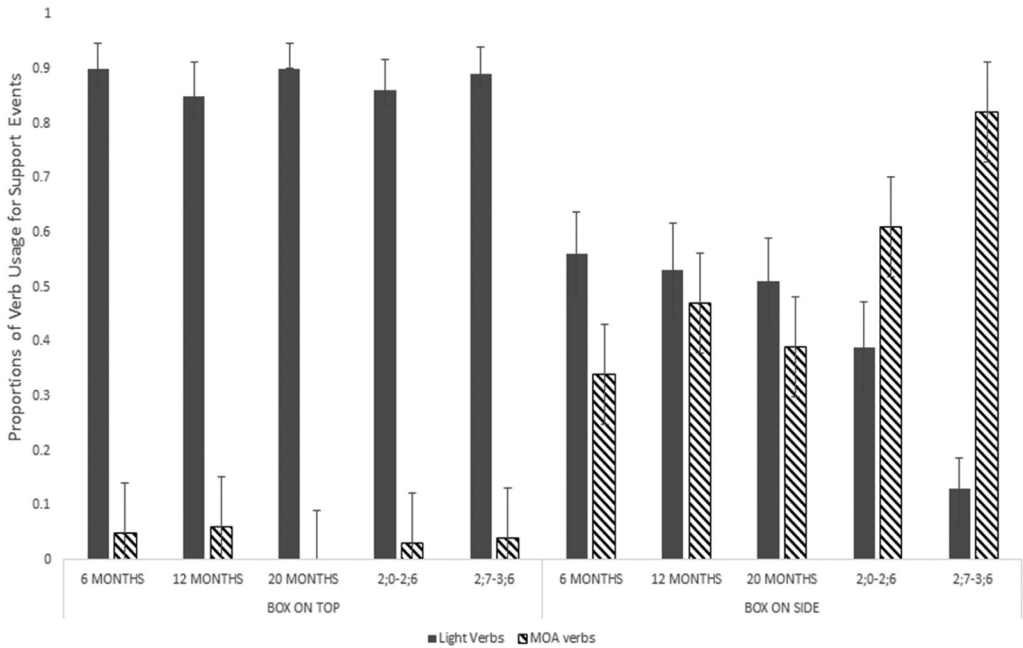


Figure 2. Distribution of Parent’s verb use (Light and Manner of Attachment – MoA) when describing the two support events to their child: BOX ON TOP (“Support-from-Below”) and BOX ON SIDE (“Mechanical Support”).

presentation (*BOX ON TOP* first or second) as fixed effects. None of these models yielded significance in predicting Light or MoA verb use.

These results suggest that parents use distinct sets of verbs when describing the SFB and Mechanical Support events to their children, with parents of the oldest children especially using more MoA verbs and fewer Light verbs to describe Mechanical Support. In the next analyses, we examine the prepositions that accompanied these verbs.

Verb + Preposition coding

Light verbs

As reported above, for the SFB event, most parents used Light verbs (mostly *put*); 97% of these uses were accompanied by *on*. In contrast, for the Mechanical Support event, fewer parents used Light verbs (mostly *put*); and these uses were accompanied by *on* only 72.8% of the time. The remaining parents who used Light verbs to encode Mechanical Support used *next to* (16.0%, e.g., “she put the little pink box *next to* the big white box”), *to* (5.0%, e.g., “we put a toy *to* the side of the box”), or another preposition (6.2%; e.g., “the block moved *up*”). Thus, when parents use Light verbs for SFB they overwhelmingly use *on*, but when they use Light verbs for Mechanical Support, the preposition that accompanies the verb varies.

In order to statistically test this differential use of a Light verb + *on* to describe the two event types, we focused on all the utterances that included a Light verb (N = 249). The raw data were coded in terms of 1/0 for the parent’s use of *on* (or not) across the two support events (SFB and Mechanical Support). We entered these data into a mixed model logistic

regression analysis with Support Type (SFB, Mechanical Support) and Age Group treated as fixed-effect factors and Subject as a random effect. Only Support Type was significant in predicting *on* used in conjunction with a Light verb; parents used *on* with Light verbs more to describe SFB (BOX ON TOP) than Mechanical Support (BOX ON SIDE) ($B = 2.45$, $p < .001$, $CI[1.90, 3.00]$). Age was not a significant factor in this model.

MoA verbs

For the SFB event, only seven parents used MoA verbs; when these verbs were used they were accompanied with *on* four times (e.g., “he took the little pink block and *stuck* it *on* top of the big block”) and with *to* three times (e.g., “the purple cube got *attached* to a square but *on* top”). In contrast, for the Mechanical Support event, MoA verbs (*stick*, *attach*, etc.) were used more frequently (52% of the parents – as reported in the verb analysis above) and were accompanied by a variety of different prepositions: *to* (62.6%; e.g., “someone picked up a block and *attached* it *to* the side of the box”), *on* (32.3%; e.g., “they took a small pink block and *stuck* it *on* the side of the white box”), *onto* (2%; e.g., “a hand picked up the pink block from the ground and *stuck* it *onto* the side of the big white box”), and *next to* (2%; e.g., “they *stuck* the block *next to* the square”). The verb occurred without a preposition only once (“the box and the small box, they are *attached*”).

In sum, when parents use MoA verbs, they overwhelmingly use *to* and *on*. The stable use of *on* with Light verbs (e.g., put *on*) and more varied use of *on* or *to* with MoA verbs (*stick*, *attach*) is further evidence for differentiated language in parents’ descriptions of SFB vs. Mechanical Support to their children.

Discussion

Parents used distinct linguistic expressions when describing SFB and Mechanical Support configurations to their children. Specifically, they overwhelmingly used Light verbs + *on* (e.g., put X on Y) for SFB (a toy being put on top of a box) and MoA verbs + *to* or *on* (e.g., stuck X to/on Y) for Mechanical Support (a toy being stuck to the side of a box). This differentiation in parent language is especially prominent by the time children are 2;7–3;6 years, with parents of the older children using more MoA verbs and fewer Light verbs to encode Mechanical Support compared to the parents of younger children, suggesting that parents are highly sensitive to their children’s age (or possibly children’s language ability). This differential language use by parents is consistent with the results reported by Johannes et al. (2016) where adults and 6-year-olds, when describing *static* configurations of support (e.g., cup on plate; stamp on envelope), used BE *on* primarily for SFB, and MoA verbs for Mechanical Support (e.g., *stick*). The current finding extends this pattern to the way that parents describe configurations representing SFB and Mechanical Support to their young children.

The finding that parents’ language to their children shows a division of labor (like that shown by adults in other contexts) suggests that the linguistic input to children differentiates the semantic space of support in a very specific way. From 6 months to 3.5 years of age, one class of verbs – Light verbs (+ *on*) – are used frequently to encode dynamic events resulting in configurations of SFB (e.g. a hand putting a block on top of a box). In contrast, two classes of verbs – Light verbs (+ *on*) and MoA verbs (+ *on/to*) – are used to encode dynamic events resulting in configurations characterized by Mechanical Support (e.g.,

a hand putting a block on the side of a box). Further, from 6 months to 3.5 years of age the frequency of MoA verb use increases for Mechanical Support events, at the expense of the Light verbs. This is exactly what one would expect if parents are sensitive to their child's age and raises the possibility that parent input plays a critical role in children's acquisition of language in this domain.

These findings set the stage for future studies to directly test whether parent input plays a role in children's language development in this domain, and if so, how. Before speculating about this, a limitation of the current study should be noted. The current study tested only two types of support configurations, with one exemplar from each type: a block on top of, and on the side of, a box. The use of such "simple" stimuli was motivated by several studies in infant cognition that explore infants' knowledge of physical support (see Baillargeon & DeJong, 2017). Thus, while the external validity of the current study may be a limitation, the internal validity is high. By using configurations highly similar to those used in studies exploring infants' reasoning about support, we were able to elicit parents' descriptions of similar configurations, and start to bridge the gap between infants' physical knowledge of support (e.g., see Baillargeon & DeJong, 2017), children's development of support language (e.g., see Lakusta et al., 2020), and how parent input may play a role (current study). Future research can test more varied exemplars of SFB and Mechanical Support, such as support via hanging, encirclement, and point attachment. We hypothesize that, similar to the findings of the current study, parents will continue to show a division of labor and describe SFB with Light verbs (e.g., put) + on, and use more lexical verbs to describe specific manners of attachment (e.g., hang, clip, etc.). Further, it's possible that parents' use of different MoA verbs will vary depending on the child's age. In the current study, parents of children 2 years and older used more MoA verbs (stick, attach) than Light verbs to describe the Mechanical Support via adhesion configuration. Would the results be similar for "hanging"? In addition, would parents show individual differences in their use of light and lexical verbs when controlling for the child's age? Lastly, would similar findings be observed for speakers of other languages, suggesting generality of our hypothesis? Although research suggests that all languages have a basic expression for encoding SFB (Levinson & Wilkins, 2006), the use of linguistic devices for encoding Mechanical Support varies across languages. Future cross-linguistic research examining parents' descriptions of varied Mechanical Support relations in conjunction with children's understanding of these relations will shed further light on the role of parent input in this domain (see Casasola et al., 2017, for such a study examining containment vs. support).

If parent input plays a critical role in children's acquisition of language in this domain, how does it do so? We hypothesize that the differentiated linguistic input that children receive from their parents may interact with children's existing conceptual space as has been suggested by prior studies. Specifically, the basic locative construction (i.e., in English, BE/Light verb + *on*) maps to the concept of SFB – a representation that has been suggested to play a "special" role in children's early understanding of physical support (see Introduction and Baillargeon & DeJong, 2017). In this case, the input to children and their own conceptual space would be in close correspondence, and children's early language should reflect this mapping (see Lakusta et al., 2020 for support of this). Further, given that a basic expression for encoding support exists cross-linguistically (Levinson & Wilkins, 2006), we predict that a division of labor in parent language to children will be observed cross-linguistically and that the close correspondence between the basic locative construction

and SFB should be a universal characteristic of early language learning. In contrast, parent input in children's acquisition of language encoding Mechanical Support may play a different role than the one described for SFB. Although SFB and the basic locative construction might be tightly correlated, Mechanical Support and its encoding won't be, simply because lots of types Mechanical Support exist. The variation will necessitate that children's acquisition is tightly tied to what expressions for what configurations are used by their linguistic community (parents, caregivers).

In sum, the current study provides the very first test of how parents describe two fundamentally different types of support configurations – Support-from-Below and Mechanical Support – to their young children. Parents' descriptions show clear linguistic differentiation early in development and their descriptions become even more divergent over their child's age. Such findings set the stage for future research to examine how such parent input to children might predict child outcomes, and whether the influence of parent input is the same for SFB vs. Mechanical Support across languages.

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